

Patent Application
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Section II. Amendments to the Claims

Please amend claims 1, 14, 19, 27, 32, 44 and 56, cancel claims 22-24, 35-37, and 48-50, and add claims 57 and 58, as set out below in the listing of claims 1-58 of the application.

1. (Currently Amended) A post CMP cleaning formulation comprising an organic amine, a fluoride source and from 70% to 98% water by weight, based on the total weight of the formulation, wherein the pH of the post CMP cleaning formulation is between about 7 and about 9.
2. (Original) The post CMP cleaning formulation according to claim 1, wherein said formulation further comprises a metal chelating agent.
3. (Original) The post CMP cleaning formulation according to claim 2, wherein said formulation further comprises a nitrogenous component.
4. (Previously Presented) The post CMP cleaning formulation according to claim 1, wherein said fluoride source comprises from about 0.1% to about 5.0% fluoride source by weight, based on the total weight of the formulation
5. (Original) The post CMP cleaning formulation according to claim 1, wherein said fluoride is selected from the group consisting of:

any combination of ammonia gas or ammonium hydroxide and hydrogen fluoride gas or hydrofluoric acid,

ammonium fluoride,

ammonium bifluoride,

triethanolammonium fluoride, (TEAF),

diglycolammonium fluoride, (DGAF),

tetramethylammonium fluoride, (TMAF),

methyldiethanolammonium fluoride, (MDEAF) and

triethylamine tris (hydrogen fluoride) (TREAT-HF).

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6. (Previously Presented) The post CMP cleaning formulation according to claim 1, wherein said formulation comprises from about 1% to 15% organic amine by weight, based on the total weight of the formulation.
7. (Previously Presented) The post CMP cleaning formulation according to claim 1, wherein said organic amine is selected from the group consisting of:
 - diglycolamine (DGA),
 - methyldiethanolamine (MDEA),
 - pentamethyldiethylenetriamine (PMDETA),
 - triethanolamine (TEA),
 - triethylenediamine (TEDA),
 - hexamethylenetetramine,
 - 3, 3-iminobis (N,N-dimethylpropylamine),
 - monoethanolamine,
 - 2-(methylamino)ethanol,
 - 4-(2-hydroxyethyl)morpholine,
 - 4-(3-aminopropyl)morpholine, and
 - N,N-dimethyl-2-(2-aminoethoxy)ethanol.
8. (Previously Presented) The post CMP cleaning formulation according to claim 2, wherein said formulation comprises from about 0 to about 5.0 % metal chelating agent by weight, based on the total weight of the formulation.
9. (Previously Presented) The post CMP cleaning formulation according to claim 2, wherein said metal chelating agent is selected from the group consisting of:
 - acetoacetamide,
 - ammonium carbamate,
 - ammonium pyrrolidinedithiocarbamate (APDC),

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dimethyl malonate,
methyl acetoacetate,
N-methyl acetoacetamide,
2,4-pentanedione,
1,1,1,5,5,5-hexafluoro-2,4-pentanedione H(hfac),
2,2,6,6-tetramethyl-3,5-heptanedione H(thd),
tetramethylammonium thiobenzoate,
tetramethylammonium trifluoroacetate,
tetramethylthiuram disulfide (TMTDS),
trifluoroacetic acid,
lactic acid,
ammonium lactate,
malonic acid,
formic acid,
acetic acid,
propionic acid,
gamma-butyrolactone,
methyldiethanolammonium trifluoroacetate, and
trifluoroacetic acid.

10. (Previously Presented) The post CMP cleaning formulation according to claim 3, wherein said formulation comprises from about 0 to about 10 % nitrogenous component by weight, based on the total weight of the formulation.
11. (Original) The post CMP cleaning formulation according to claim 3, wherein said nitrogenous component is selected from the group consisting of:

iminodiacetic acid (IDA),

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glycine,
nitrilotriacetic acid (NTA),
hydroxyethyliminodiacetic acid,
1,1,3,-tetramethylguanidine (TMG),
ethylenediaminetetracetic acid (EDTA),
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NH})\text{CH}_2\text{C}(\text{O})\text{CH}_3$,
 $(\text{CH}_3\text{CH}_2)_2\text{NC}(=\text{NH})\text{N}(\text{CH}_3\text{CH}_2)_2$,
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)_2$, and
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{COOH}$.

12. (Previously Presented) The post CMP cleaning formulation according to claim 1, wherein said formulation comprises the following components in the percentage by weight shown, based on the total weight of such formulation:

triethanolamine	4.5 %,
ammonium Fluoride	0.5 %, and
water	95 %.

13. (Previously Presented) The post CMP cleaning formulation according to claim 1, wherein said formulation comprises the following components in the percentage by weight ranges shown, based on the total weight of such formulation:

PMDTA	3.8-4.5 %,
ammonium fluoride	0.5 %,
2, 4-Pentanedione	1 %, and
water	94-94.7 %.

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14. (Currently Amended) The post CMP cleaning formulation according to claim 1, wherein said formulation comprises the following components in the percentage by weight shown, based on the total weight of such formulation:

TEA	1.7 %
PMDETA	1.5 %
[[TEAHF]] <u>TEAF</u>	2 %,
iminodiacetic Acid	0.4 %,
ammonium bifluoride	0.5 %, and
water	93.9 %.

15. (Previously Presented) The post CMP cleaning formulation according to claim 1, wherein said formulation comprises the following components in the percentage by weight shown, based on the total weight of such formulation:

TEA	3.5 %,
PMDETA	1.5 %,
2, 4-Pentanedione	1.35 %,
ammonium fluoride	1.2 %, and
water	92.45 %.

16. (Previously Presented) The post CMP cleaning formulation according to claim 1, wherein said formulation comprises the following components in the percentage by weight shown, based on the total weight of such formulation:

TEA	7 %,
PMDETA	3 %,
2, 4-Pentanedione	2.7 %,
ammonium fluoride	2.4 %, and
water	84.9 %.

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17. (Previously Presented) A semiconductor wafer cleaning formulation comprising the following components in the percentage by weight ranges shown, based on the total weight of such components:

fluoride source	1-35%
organic amine(s)	20-60%
a nitrogenous component, selected from nitrogen-containing carboxylic acids and imines	0.1-40%
water	20-50% and
metal chelating agent(s)	0-21%
TOTAL	100%.

18. (Previously Presented) The cleaning formulation of claim 17, wherein said fluoride source comprises a fluoride species selected from the group consisting of:

any combination of ammonia gas or ammonium hydroxide and hydrogen fluoride gas or hydrofluoric acid,
ammonium bifluoride,
ammonium fluoride,
triethanolammonium fluoride (TEAF),
diglycolammonium fluoride (DGAF),
tetramethylammonium fluoride (TMAF),
methyldiethanolammonium fluoride (MDEAF), and
triethylamine tris (hydrogen fluoride) (TREAT-HF).

19. (Currently Amended) The cleaning formulation of claim 17, wherein said organic amine(s) comprise an amine(s) selected from the group consisting of:

diglycolamine (DGA),
methyldiethanolamine (MDEA),

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pentamethyldiethylenetriamine (PMDETA),

triethanolamine (TEA),

triethylenediamine (TEDA),

hexamethylenetetramine,

3, 3-iminobis (N,N-dimethylpropylamine),

monoethanolamine,

2-(methylamino)ethanol,

4-(2-hydroxyethyl)morpholine,

4-(3-aminopropyl)morpholine, and

N,N-dimethyl-2-(2-aminoethoxy)ethanol.

20. (Previously Presented) The cleaning formulation of claim 17, wherein said nitrogenous component comprises a species selected from the group consisting of:

iminodiacetic acid (IDA),

glycine,

nitrilotriacetic acid (NTA),

hydroxyethyliminodiacetic acid,

1,1,3,-tetramethylguanidine (TMG),

ethylenediaminetetracetic acid (EDTA),

$\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,

$\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,

$\text{CH}_3\text{C}(=\text{NH})\text{CH}_2\text{C}(\text{O})\text{CH}_3$,

$(\text{CH}_3\text{CH}_2)_2\text{NC}(=\text{NH})\text{N}(\text{CH}_3\text{CH}_2)_2$,

$\text{HOOCCH}_2\text{N}(\text{CH}_3)_2$, and

$\text{HOOCCH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{COOH}$.

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21. (Previously Presented) The cleaning formulation of claim 17, including at least one metal chelating agent selected from the group consisting of:

acetoacetamide,
ammonium carbamate,
ammonium pyrrolidinedithiocarbamate (APDC),
dimethyl malonate,
methyl acetoacetate,
N-methyl acetoacetamide,
2,4-pentanedione,
1,1,1,5,5,5-hexafluoro-2,4-pentanedione H(hfac),
2,2,6,6-tetramethyl-3,5-heptanedione H(thd),
tetramethylammonium thiobenzoate,
tetramethylammonium trifluoroacetate,
tetramethylthiuram disulfide (TMTDS),
trifluoroacetic acid,
lactic acid,
ammonium lactate,
malonic acid,
formic acid,
acetic acid,
propionic acid,
gamma-butyrolactone,
iminodiacetic acid,
methyldiethanolammonium trifluoroacetate, and
trifluoroacetic acid.

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22-24 (Cancelled)

25. (Previously Presented) The cleaning formulation of claim 17, wherein said fluoride source comprises a species selected from the group consisting of:

any combination of ammonia gas or ammonium hydroxide and hydrogen fluoride gas or hydrofluoric acid,
ammonium fluoride,
ammonium bifluoride,
triethanolammonium fluoride (TEAF),
diglycolammonium fluoride (DGAF),
methyldiethanolammonium fluoride (MDEAF),
tetramethylammonium fluoride (TMAF), and
triethylamine tris (hydrogen fluoride) (TREAT-HF);

said organic amine(s) comprise a species selected from the group consisting of:

diglycolamine (DGA),
methyldiethanolamine (MDEA),
pentamethyldiethylenetriamine (PMDETA),
triethanolamine (TEA),
triethylenediamine (TEDA),
hexamethylenetetramine,
3, 3-iminobis (N,N-dimethylpropylamine),
monoethanolamine,
2-(methylamino)ethanol,
4-(2-hydroxyethyl)morpholine,
4-(3-aminopropyl)morpholine, and
N,N-dimethyl-2-(2-aminoethoxy)ethanol;

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said nitrogenous component comprises a species selected from the group consisting of:

iminodiacetic acid (IDA),
glycine,
nitrilotriacetic acid (NTA),
hydroxyethyliminodiacetic acid,
1,1,3,-tetramethylguanidine (TMG),
ethylenediaminetetracetic acid (EDTA),
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NH})\text{CH}_2\text{C}(\text{O})\text{CH}_3$,
 $(\text{CH}_3\text{CH}_2)_2\text{NC}(=\text{NH})\text{N}(\text{CH}_3\text{CH}_2)_2$,
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)_2$, and
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{COOH}$; and

said formulation includes a metal chelating agent comprising a species selected from the group consisting of:

acetoacetamide,
ammonium carbamate,
ammonium pyrrolidinedithiocarbamate (APDC),
dimethyl malonate,
methyl acetoacetate,
N-methyl acetoacetamide,
2,4-pentanedione,
1,1,1,5,5,5-hexafluoro-2,4-pentanedione H(hfac),
2,2,6,6-tetramethyl-3,5-heptanedione H(thd),
tetramethylammonium thiobenzoate,

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tetramethylammonium trifluoroacetate,
tetramethylthiuram disulfide (TMTDS),
trifluoroacetic acid,
lactic acid,
ammonium lactate,
malonic acid,
formic acid,
acetic acid,
propionic acid,
gamma-butyrolactone,
iminodiacetic acid,
methyldiethanolammonium trifluoroacetate, and
trifluoroacetic acid.

26. (Original) The cleaning formulation of claim 17, wherein said fluoride source comprises a compound having the general formula $R_1R_2R_3R_4NF$ in which each of the R groups is independently selected from hydrogen atoms and aliphatic groups, and wherein said formulation includes a metal chelating agent of the formula:



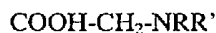
in which R is either hydrogen or an aliphatic group and X and Y are functional groups containing multiply bonded moieties having electron-withdrawing properties.

27. (Currently Amended) The cleaning formulation of claim ~~25~~ 26, wherein each of X and Y is independently selected from $CONH_2$, $CONHR'$, CN , NO_2 , SOR' , and SO_2Z in which R' is alkyl and Z is hydrogen, halo, or alkyl.
28. (Original) The cleaning formulation of claim 17, wherein said fluoride source comprises a compound having the formula $R_1R_2R_3R_4NF$ in which each of the R groups is hydrogen or

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aliphatic, and wherein said formulation includes a metal chelating agent of the formula, $R_1R_2R_3R_4N^+ \cdot O_2CCF_3$ in which each of the R groups is independently hydrogen or aliphatic.

29. (Original) The cleaning formulation of claim 17, wherein said nitrogenous component includes a compound having the formula:



wherein each of R and R' is independently selected from the group consisting of hydrogen, alkyl, aryl, and carboxylic acids.

30. (Withdrawn) A method for fabricating a semiconductor wafer, comprising:

plasma etching a metallized layer from a surface of the wafer;

plasma ashing a resist from the surface of the wafer; and

cleaning the wafer by contacting same with a cleaning formulation, comprising the following components in the percentage by weight ranges shown, based on the total weight of such components:

fluoride source	1-35%
organic amine(s)	20-60%
a nitrogenous component, selected from nitrogen-containing carboxylic acids and imines	0.1-40%
water	20-50%
metal chelating agent(s)	0-21%
TOTAL	100%.

31. (Withdrawn) The method of claim 30, wherein said fluoride source comprises a fluoride species selected from the group consisting of:

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any combination of ammonia gas or ammonium hydroxide and hydrogen fluoride gas or hydrofluoric acid,

ammonium fluoride,

ammonium bifluoride,

triethanolammonium fluoride (TEAF),

diglycolammonium fluoride (DGAF),

methyldiethanolammonium fluoride (MDEAF),

tetramethylammonium fluoride (TMAF), and

triethylamine tris (hydrogen fluoride) (TREAT-HF).

32. (Withdrawn) The method of claim 30, wherein said organic amine(s) comprise an amine(s) selected from the group consisting of:

diglycolamine (DGA),

methyldiethanolamine (MDEA),

pentamethyldiethylenetriamine (PMDETA),

triethanolamine (TEA),

triethylenediamine (TEDA),

hexamethylenetetramine,

3, 3-iminobis (N,N-dimethylpropylamine),

monoethanolamine,

2-(methylamino)ethanol,

4-(2-hydroxyethyl)morpholine,

4-(3-aminopropyl)morpholine, and

N,N-dimethyl-2-(2-aminoethoxy)ethanol.

33. (Withdrawn) The method of claim 30, wherein said nitrogenous component comprises a species selected from the group consisting of:

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iminodiacetic acid (IDA),
glycine,
nitrilotriacetic acid (NTA),
hydroxyethyliminodiacetic acid,
1,1,3,-tetramethylguanidine (TMG),
ethylenediaminetetracetic acid (EDTA),
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NH})\text{CH}_2\text{C}(\text{O})\text{CH}_3$,
 $(\text{CH}_3\text{CH}_2)_2\text{NC}(=\text{NH})\text{N}(\text{CH}_3\text{CH}_2)_2$,
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)_2$,
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{COOH}$.

34. (Withdrawn) The method of claim 30, including at least one metal chelating agent selected from the group consisting of:

acetoacetamide,
ammonium carbamate,
ammonium pyrrolidinedithiocarbamate (APDC),
dimethyl malonate,
methyl acetoacetate,
N-methyl acetoacetamide,
2,4-pentanedione,
1,1,1,5,5,5-hexafluoro-2,4-pentanedione H(hfac),
2,2,6,6-tetramethyl-3,5-heptanedione H(thd),
tetramethylammonium thiobenzoate,
tetramethylammonium trifluoroacetate,

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tetramethylthiuram disulfide (TMTDS),
trifluoroacetic acid,
lactic acid,
ammonium lactate,
malonic acid,
formic acid,
acetic acid,
propionic acid,
gamma-butyrolactone,
iminodiacetic acid,
methyldiethanolammonium trifluoroacetate, and
trifluoroacetic acid.

35-37 (Cancelled)

38. (Withdrawn) The method of claim 30, wherein said fluoride source comprises a species selected from the group consisting of:

any combination of ammonia gas or ammonium hydroxide and hydrogen fluoride gas or hydrofluoric acid,
ammonium fluoride,
ammonium bifluoride,
triethanolammonium fluoride (TEAF),
diglycolammonium fluoride (DGAF),
methyldiethanolammonium fluoride (MDEAF),
tetramethylammonium fluoride (TMAF), and
triethylamine tris (hydrogen fluoride) (TREAT-HF);

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said organic amine(s) comprise a species selected from the group consisting of:

diglycolamine (DGA),
methyldiethanolamine (MDEA),
pentamethyldiethylenetriamine (PMDETA),
triethanolamine (TEA),
triethylenediamine (TEDA),
hexamethylenetetramine,
3, 3-iminobis (N,N-dimethylpropylamine),
monoethanolamine,
2-(methylamino)ethanol,
4-(2-hydroxyethyl)morpholine,
4-(3-aminopropyl)morpholine, and
N,N-dimethyl-2-(2-aminoethoxy)ethanol;

said nitrogenous component comprises a species selected from the group consisting of:

iminodiacetic acid (IDA),
glycine,
nitrilotriacetic acid (NTA),
hydroxyethyliminodiacetic acid,
1,1,3,-tetramethylguanidine (TMG),
ethylenediaminetetracetic acid (EDTA),
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NH})\text{CH}_2\text{C}(\text{O})\text{CH}_3$,
 $(\text{CH}_3\text{CH}_2)_2\text{NC}(=\text{NH})\text{N}(\text{CH}_3\text{CH}_2)_2$,
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)_2$, and

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$\text{HOOCCH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{COOH}$; and

said formulation includes a metal chelating agent comprising a species selected from the group consisting of:

acetoacetamide,
ammonium carbamate,
ammonium pyrrolidinedithiocarbamate (APDC),
dimethyl malonate,
methyl acetoacetate,
N-methyl acetoacetamide,
2,4-pentanedione,
1,1,1,5,5,5-hexafluoro-2,4-pentanedione H(hfac),
2,2,6,6-tetramethyl-3,5-heptanedione H(thd),
tetramethylammonium thiobenzoate,
tetramethylammonium trifluoroacetate,
tetramethylthiuram disulfide (TMTDS),
trifluoroacetic acid,
lactic acid,
ammonium lactate,
malonic acid,
formic acid,
acetic acid,
propionic acid,
gamma-butyrolactone,
iminodiacetic acid,
methyldiethanolammonium trifluoroacetate, and

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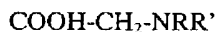
trifluoroacetic acid.

39. (Withdrawn) The method of claim 30, wherein said fluoride source comprises a compound having the general formula $R_1R_2R_3R_4NF$ in which each of the R groups is independently selected from hydrogen atoms and aliphatic groups, and wherein said formulation includes a metal chelating agent of the formula:



in which R is either hydrogen or an aliphatic group and X and Y are functional groups containing multiply bonded moieties having electron-withdrawing properties.

40. (Withdrawn) The method of claim 39, wherein each of X and Y is independently selected from $CONH_2$, $CONHR'$, CN , NO_2 , SOR' , and SO_2Z in which R' is alkyl and Z is hydrogen, halo, or alkyl.
41. (Withdrawn) The method of claim 30, wherein said fluoride source comprises a compound having the formula $R_1R_2R_3R_4NF$ in which each of the R groups is hydrogen or aliphatic, and wherein said formulation includes a metal chelating agent of the formula, $R_1R_2R_3R_4N^+ O_2CCF_3$ in which each of the R groups is independently hydrogen or aliphatic.
42. (Withdrawn) The method of claim 30, wherein said nitrogenous component includes a compound having the formula:



wherein each of R and R' is independently selected from the group consisting of hydrogen, alkyl, aryl, and carboxylic acids.

43. (Withdrawn) A method for fabricating a semiconductor wafer including the steps comprising:
- plasma etching a metallized layer from a surface of the wafer;
- plasma ashing a resist from the surface of the wafer;

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cleaning the wafer by contacting same with a cleaning formulation, comprising the following components in the percentage by weight ranges shown, based on the total weight of such components:

a fluoride source;	1-35%
at least one organic amine;	20-60%
a nitrogen-containing carboxylic acid or imine	0.1-40%
water;	20-50%
at least one metal chelating agent	0-21%
TOTAL	100%.

44. (Withdrawn) The method of claim 43, wherein said fluoride source is ~~chosen~~ selected from the group consisting of:

any combination of ammonia gas or ammonium hydroxide and hydrogen fluoride gas or hydrofluoric acid,

ammonium fluoride,

ammonium bifluoride,

triethanolammonium fluoride (TEAF),

diglycolammonium fluoride (DGAF),

methyldiethanolammonium fluoride (MDEAF),

tetramethylammonium fluoride (TMAF), and

triethylamine tris (hydrogen fluoride) (TREAT-HF).

45. (Withdrawn) The method of claim 43, wherein said organic amine is selected from the group consisting of:

diglycolamine (DGA),

methyldiethanolamine (MDEA),

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pentamethyldiethylenetriamine (PMDETA),
triethanolamine (TEA),
triethylenediamine (TEDA),
hexamethylenetetramine,
3, 3-iminobis (N,N-dimethylpropylamine),
monoethanolamine,
2-(methylamino)ethanol,
4-(2-hydroxyethyl)morpholine,
4-(3-aminopropyl)morpholine, and
N,N-dimethyl-2-(2-aminoethoxy)ethanol.

46. (Withdrawn) The method of claim 43, wherein said nitrogen-containing carboxylic acid or imine is selected from the group consisting of:

iminodiacetic acid (IDA),
glycine,
nitrilotriacetic acid (NTA),
hydroxyethyliminodiacetic acid,
1,1,3,-tetramethylguanidine (TMG),
ethylenediaminetetracetic acid (EDTA),
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NH})\text{CH}_2\text{C}(\text{O})\text{CH}_3$,
 $(\text{CH}_3\text{CH}_2)_2\text{NC}(=\text{NH})\text{N}(\text{CH}_3\text{CH}_2)_2$,
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)_2$, and
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{COOH}$.

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47. (Withdrawn) The method of claim 43, wherein said metal chelating agent is selected from the group consisting of:

acetoacetamide,
ammonium carbamate,
ammonium pyrrolidinedithiocarbamate (APDC),
dimethyl malonate,
methyl acetoacetate,
N-methyl acetoacetamide,
2,4-pentanedione,
1,1,1,5,5,5-hexafluoro-2,4-pentanedione H(hfac),
2,2,6,6-tetramethyl-3,5-heptanedione H(thd),
tetramethylammonium thiobenzoate,
tetramethylammonium trifluoroacetate,
tetramethylthiuram disulfide (TMTDS),
lactic acid,
ammonium lactate,
malonic acid,
formic acid,
acetic acid,
propionic acid,
gamma-butyrolactone,
methyldiethanolammonium trifluoroacetate, and
trifluoroacetic acid.

- 48-50 (Cancelled)

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51. (Withdrawn) The method of claim 43, wherein said fluoride source is selected from the group consisting of:

any combination of ammonia gas or ammonium hydroxide and hydrogen fluoride gas or hydrofluoric acid,
ammonium fluoride,
ammonium bifluoride,
triethanolammonium fluoride (TEAF),
diglycolammonium fluoride (DGAF),
methyldiethanolammonium fluoride (MDEAF),
tetramethylammonium fluoride (TMAF), and
triethylamine tris (hydrogen fluoride) (TREAT-HF);

said organic amine(s) comprise a species selected from the group consisting of:

diglycolamine (DGA),
methyldiethanolamine (MDEA),
pentamethyldiethylenetriamine (PMDETA),
triethanolamine (TEA),
triethylenediamine (TEDA),
hexamethylenetetramine,
3, 3-iminobis (N,N-dimethylpropylamine),
monoethanolamine,
2-(methylamino)ethanol,
4-(2-hydroxyethyl)morpholine,
4-(3-aminopropyl)morpholine, and
N,N-dimethyl-2-(2-aminoethoxy)ethanol;

said nitrogenous component comprises a species selected from the group consisting of:

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iminodiacetic acid (IDA),
glycine,
nitrilotriacetic acid (NTA),
hydroxyethyliminodiacetic acid,
1,1,3,-tetramethylguanidine (TMG),
ethylenediaminetetracetic acid (EDTA),
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OH})\text{CH}_2\text{C}(\text{O})\text{N}(\text{CH}_3)_2$,
 $\text{CH}_3\text{C}(=\text{NH})\text{CH}_2\text{C}(\text{O})\text{CH}_3$,
 $(\text{CH}_3\text{CH}_2)_2\text{NC}(=\text{NH})\text{N}(\text{CH}_3\text{CH}_2)_2$,
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)_2$, and
 $\text{HOOCCH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{COOH}$; and

said formulation includes a metal chelating agent comprising a species selected from the group consisting of:

acetoacetamide,
ammonium carbamate,
ammonium pyrrolidinedithiocarbamate (APDC),
dimethyl malonate,
methyl acetoacetate,
N-methyl acetoacetamide,
2,4-pentanedione,
1,1,1,5,5,5-hexafluoro-2,4-pentanedione H(hfac),
2,2,6,6-tetramethyl-3,5-heptanedione H(thd),
tetramethylammonium thiobenzoate,
tetramethylammonium trifluoroacetate,

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tetramethylthiuram disulfide (TMTDS),
trifluoroacetic acid,
lactic acid,
ammonium lactate,
malonic acid,
formic acid,
acetic acid,
propionic acid,
gamma-butyrolactone,
iminodiacetic acid,
methyldiethanolammonium trifluoroacetate, and
trifluoroacetic acid.

52. (Withdrawn) The method of claim 43, wherein said fluoride source comprises a compound having the formula $R_1R_2R_3R_4NF$ in which each of the R groups is hydrogen atoms or aliphatic, and wherein said metal chelating agent has the formula:

$X-CHR-Y$,

in which R is either hydrogen or an aliphatic group, and X and Y are functional groups containing multiply-bonded moieties having electron-withdrawing properties.

53. (Withdrawn) The method of claim 43, wherein said fluoride source comprises a compound having the formula $R_1R_2R_3R_4NF$ in which each of the R groups is hydrogen or aliphatic, and wherein said metal chelating agent has the formula, $R_1R_2R_3R_4N^+ \cdot O_2CCF_3$ in which each of the R groups is hydrogen or aliphatic.
54. (Withdrawn) The method of claim 43, wherein said nitrogen-containing carboxylic acid has the formula:

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$\text{COOH-CH}_2\text{-NRR'}$

wherein each of R and R' is independently selected from the group consisting of hydrogen, alkyl, aryl, and carboxylic acid.

55. (Withdrawn) A method of removing residue from a wafer following a resist plasma ashing step on said wafer, comprising contacting the wafer with a cleaning formulation, including (i) a fluoride source, (ii) at least one organic amine, (iii) a nitrogen-containing carboxylic acid or an imine, (iv) water, and optionally at least one metal chelating agent.
56. (Currently Amended) A wafer cleaning formulation, including (i) a fluoride source, (ii) at least one organic amine, (iii) a nitrogen-containing carboxylic acid or an imine, (iv) water, and optionally at least one metal chelating agent, wherein the pH of the wafer cleaning formulation is between about 7 and about 9.
57. (New) A semiconductor wafer cleaning formulation comprising the following components in the percentage by weight ranges shown, based on the total weight of such components:

fluoride source	1-35%
organic amine(s)	20-60%
a nitrogenous component, selected from nitrogen-containing carboxylic acids and imines	0.1-40%
water	20-50% and
metal chelating agent(s)	0-21%
TOTAL	100%,

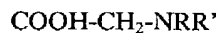
wherein said fluoride source comprises a compound having the formula $\text{R}_1\text{R}_2\text{R}_3\text{R}_4\text{NF}$ in which each of the R groups is hydrogen or aliphatic, and wherein said formulation includes a metal chelating agent of the formula, $\text{R}_1\text{R}_2\text{R}_3\text{R}_4\text{N}^+ \text{O}_2\text{CCF}_3$ in which each of the R groups is independently hydrogen or aliphatic.

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58. (New) A semiconductor wafer cleaning formulation comprising the following components in the percentage by weight ranges shown, based on the total weight of such components:

fluoride source	1-35%
organic amine(s)	20-60%
a nitrogenous component, selected from nitrogen-containing carboxylic acids and imines	0.1-40%
water	20-50% and
metal chelating agent(s)	0-21%
TOTAL	100%,

wherein said nitrogenous component includes a compound having the formula:



wherein each of R and R' is independently selected from the group consisting of hydrogen, alkyl, aryl, and carboxylic acids.